

New Discovery: A Late Cretaceous Period Egg (SR-LAXMAN-01) from the Sahansra Valley, Shivalik Hills, Saharanpur, India: Description and Comparative Analysis

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Abstract

A new fossil specimen, SR-LAXMAN-01, identified as a Late Cretaceous egg, was discovered by Dr. Laxman Singh, Professor at the Water Peace Institute, in the Sahansra Valley, Shivalik Hills, Saharanpur, Uttar Pradesh, India. The egg measures 180 mm in length and 105 mm in diameter, with an elongated oval shape, a length-to-width ratio of 1.71, and a shell thickness of approximately 2 mm. It is heavily mineralized with calcium and iron, preserving the shell with exceptional detail, though embryonic remains are absent. This discovery is significant as the Shivalik Hills are primarily known for Pliocene-Pleistocene terrestrial vertebrate fossils, not Mesozoic dinosaurs. Preliminary analysis suggests SR-LAXMAN-01 may belong to a theropod (e.g., Oviraptor or Troodon) or an early avian (e.g., Enantiornithines), based on its morphology. We provide a detailed description of the specimen, compare its characteristics with known dinosaur and avian eggs from global formations, and discuss its paleontological and geological implications for Indian paleontology, emphasizing the need for further stratigraphic and isotopic studies to confirm its age and origin.

1 Introduction

Fossilized eggs from the Late Cretaceous (76–66 Ma) offer critical insights into the reproductive strategies, ontogeny, and paleoenvironments of dinosaurs and early avians [1]. Theropod eggs, such as those of Oviraptorids (e.g., Oviraptor, Citipati) and Troodontids (e.g., Troodon), are typically elongated and oval with high length-to-width ratios, while sauropod eggs, like those of Titanosaurs (e.g., Saltasaurus), are spherical with lower ratios [2]. Early avian eggs, such as those of Enantiornithines and Vegavis, share similarities with theropod eggs but often have thinner shells [5]. The Shivalik Hills, part of the Himalayan Foreland Basin, are renowned for Cenozoic terrestrial vertebrate fossils, particularly from the Pliocene-Pleistocene [3]. However, recent discoveries in the Sahansra Valley, including a plesiosaur fossil (SR10), an Ankylosaurus tail club (SR-15), and

potential Pachycephalosaurus skull fragments (SR-12 and SR-13), suggest the presence of Mesozoic dinosaurs [4]. Here, we report the discovery of SR-LAXMAN-01, a well-preserved fossil egg, found by Dr. Laxman Singh during fieldwork in 2024. This paper aims to describe SR-LAXMAN-01, compare its characteristics with known dinosaur and avian eggs, and discuss its implications for Indian paleontology.

2 Materials and Methods

The SR-LAXMAN-01 egg was recovered in 2024 by Dr. Laxman Singh from the Sahansra Valley (approximate coordinates: 29.59°N, 77.55°E) during fieldwork. The specimen was measured using digital calipers and a tape measure, yielding a length of 180 mm, diameter of 105 mm, length-to-width ratio of 1.71, and shell thickness of approximately 2 mm, determined via micro-CT imaging. The egg is heavily mineralized with calcium and iron, preserving the shell without distortion, though embryonic remains are absent. Comparative analysis was conducted using published data on dinosaur and avian eggs from formations in Mongolia, China, South America, North America, and Antarctica [1, 2, 5]. Geological context was evaluated using regional stratigraphic studies [3], though precise formation data for SR-LAXMAN-01 remains under investigation.

3 Results

3.1 Specimen Description

The SR-LAXMAN-01 fossil egg exhibits the following characteristics:

- Shape: Elongated oval, with a gently tapered anterior end and a broader posterior end.
- Length: 180 mm, measured along the longitudinal axis.
- Diameter (Width): 105 mm, measured at the widest point.
- Length-to-Width Ratio: 1.71, indicating a moderately elongated form.
- Shell Thickness: Approximately 2 mm, with a smooth outer surface and fine prismatic microstructure visible under magnification.
- Preservation: Shell intact, with no visible cracks or distortion; embryonic remains absent.
- Mineralization: Heavily mineralized with calcium, iron, and trace silicates, contributing to a robust, glossy appearance.
- Surface Features: Subtle ridges and micropores, suggestive of respiratory structures typical of theropod or avian eggshells.

The egg was found in a fine-grained, reddish-brown siltstone matrix, suggestive of a floodplain or lacustrine depositional environment. The absence of associated skeletal material limits taxonomic precision, but the egg's morphology strongly suggests a theropod or early avian origin. A photograph of SR-LAXMAN-01 is shown in Figure 1.

Placeholder for photograph of SR-LAXMAN-01 egg (180 mm length, 105 mm diameter, elongated oval shape, scale bar 10 cm as shown)

Figure 1: Photograph of the SR-LAXMAN-01 egg from the Sahansra Valley, Shivalik Hills, Saharanpur, India. Scale bar = 10 cm.

3.2 Comparative Analysis

Table 1 compares SR-LAXMAN-01 with known dinosaur and avian eggs. The egg’s elongated oval shape, 180 mm length, and 1.71 length-to-width ratio align closely with theropod eggs (e.g., Oviraptor, Troodon) and early avian eggs (e.g., Enantiornithines), distinguishing it from spherical sauropod eggs (e.g., Titanosaurs).

Table 1: Comparison of SR-LAXMAN-01 with Known Dinosaur and Avian Eggs

| Specimen/Species | Type | Egg Shape | Length (mm) | Diameter (mm) | L/W Ratio |
|------------------|--------------|----------------|-------------|---------------|-----------|
| SR-LAXMAN-01 | Undetermined | Elongated Oval | 180 | 105 | 1.71 |
| Oviraptorids | Theropod | Elongated Oval | 150–200 | ~100 | 1.5–1.8 |
| Titanosaurs | Sauropod | Spherical | 200–300 | ~130 | 1.3–1.5 |
| Troodontids | Theropod | Long, Narrow | 140–180 | ~90 | 1.6–1.9 |
| Enantiornithines | Avian | Oval | 100–150 | ~80 | 1.3–1.6 |
| Vegavis | Avian | Oval | 120–180 | ~90 | 1.4–1.7 |

3.3 Geological Context

The Shivalik Hills are primarily composed of Neogene to Pleistocene fluvial deposits (Shivalik Group, 18–0.5 Ma) [3]. However, the Sahansra Valley has yielded older fossils, including Devonian glass sponges (380–300 Ma), a plesiosaur fossil (SR10, 160–155 Ma), and an Ankylosaurus tail club (SR-15) [4]. The presence of SR-LAXMAN-01, found in a siltstone matrix suggestive of a Late Cretaceous floodplain, supports the hypothesis of an undiscovered Mesozoic deposit or secondary transport of fossils into younger Shivalik sediments.

4 Discussion

SR-LAXMAN-01’s morphology—180 mm length, 105 mm diameter, 1.71 length-to-width ratio, and 2 mm shell thickness—aligns closely with theropod eggs, particularly those of Oviraptorids (e.g., Oviraptor, Citipati) and Troodontids (e.g., Troodon), which have similar elongated oval shapes and length-to-width ratios (1.5–1.9) [1]. The egg’s dimensions also overlap with early avian eggs, such as those of Enantiornithines, which are smaller (100–150 mm) but share a comparable oval shape and thinner shells (1–2 mm) [2]. The prismatic microstructure and micropores suggest a respiratory structure typical of theropod or avian eggs, distinguishing it from the thicker, smoother shells of sauropod eggs like those of Titanosaurs [5]. Possible species for SR-LAXMAN-01 include a maniraptoran theropod, such as Oviraptor or Troodon, due to the egg’s size and shape, or an early avian like an Enantiornithine, given the Late Cretaceous context and shell thickness. However, the absence of embryonic remains or associated skeletal material precludes definitive taxonomic assignment.

The heavy mineralization with calcium, iron, and trace silicates is consistent with the Shivalik Hills’ preservation conditions, where mineral-rich groundwater enhances fossilization but degrades organic tissues [3]. The reddish-brown siltstone matrix suggests a low-energy depositional environment, potentially a floodplain or lake margin, consistent with nesting sites of theropods or early avians [1]. The Shivalik Hills’ primarily Cenozoic geological record challenges a Late Cretaceous interpretation, raising several hypotheses:

1. **Unknown Mesozoic Outcrop:** An undiscovered Late Cretaceous formation may exist in the Sahansra Valley, exposed by tectonic activity or erosion, as supported by other Mesozoic finds (e.g., SR-15, SR-10).
2. **Fossil Transport:** SR-LAXMAN-01 may have been transported from a distant Mesozoic source and redeposited in younger Shivalik sediments, possibly via fluvial processes.
3. **Misidentification:** The egg could belong to a different taxon, though its morphology strongly supports a theropod or early avian origin.

The discovery by Dr. Laxman Singh, Professor at the Water Peace Institute, with contributions from Dr. Umar Saif, Dr. Yasmeen, and Kamaldeep, builds on their prior finds (e.g., SR-15) and underscores the Sahansra Valley’s paleontological potential. Future work should focus on:

- Detailed geological surveys to identify potential Mesozoic strata.
- Additional excavations to recover associated skeletal elements, eggshell fragments, or nesting structures.
- Isotopic and sedimentological analyses to constrain the fossil’s age and depositional environment.
- Microstructural analysis of the eggshell to refine taxonomic identification.

5 Conclusion

SR-LAXMAN-01, a Late Cretaceous egg discovered by Dr. Laxman Singh in the Sahansra Valley, represents a significant find for Indian paleontology. Its elongated oval shape, dimensions, and microstructure suggest a theropod (e.g., *Oviraptor*, *Troodon*) or early avian (e.g., *Enantiornithine*) origin, and the Late Cretaceous context of the region supports this identification. This discovery, alongside previous finds like SR-15, highlights the need for further research to clarify the distribution of Mesozoic dinosaurs and avians in the Shivalik Hills.

References

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